IEM's AI Modeling: Short-term COVID-19 Projections

Date: 5/20/21

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 5/20/21 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

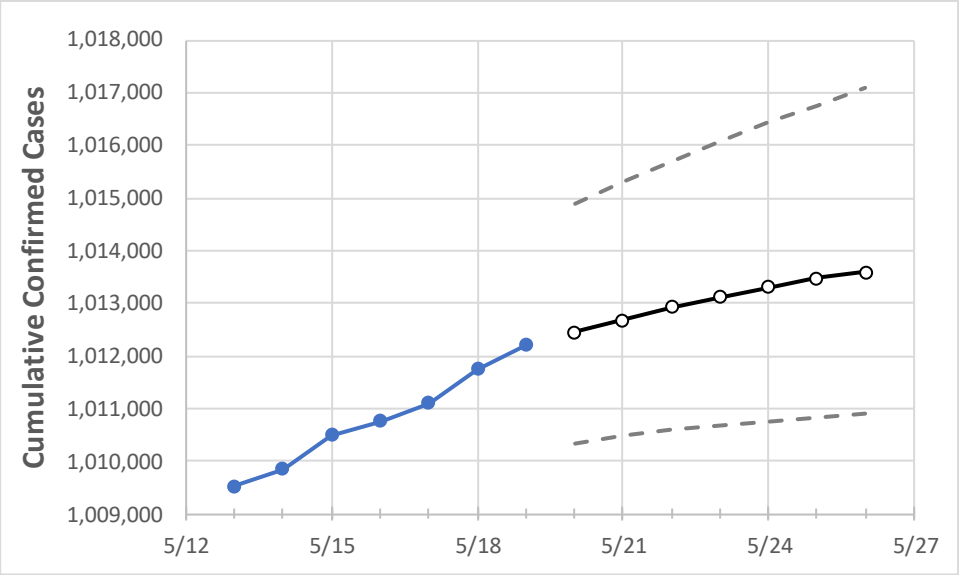
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

New Jersey State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26
New Jersey	1,010,759	1,011,106	1,011,752	1,012,196	1,012,454	1,012,686	1,012,919	1,013,113	1,013,298	1,013,467	1,013,595

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

New Jersey Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26
Bergen	103,752	103,797	103,831	103,872	103,926	103,976	104,020	104,068	104,106	104,144	104,182
Burlington	44,086	44,119	44,118	44,053	44,071	44,089	44,105	44,119	44,133	44,146	44,158
Camden	55,019	55,066	55,132	55,179	55,217	55,252	55,284	55,316	55,345	55,373	55,400
Essex	93,538	93,539	93,610	93,686	93,705	93,721	93,736	93,749	93,762	93,772	93,782
Gloucester	30,254	30,276	30,318	30,338	30,356	30,372	30,389	30,403	30,417	30,430	30,442
Hudson	87,613	87,611	87,622	87,651	87,678	87,702	87,723	87,743	87,762	87,780	87,797
Hunterdon	9,701	9,704	9,717	9,722	9,728	9,734	9,740	9,745	9,750	9,755	9,759
Mercer	33,705	33,725	33,754	33,744	33,758	33,772	33,784	33,795	33,807	33,817	33,828
Middlesex	91,630	91,657	91,704	91,750	91,768	91,785	91,801	91,815	91,828	91,841	91,852
Monmouth	75,042	75,065	75,121	75,167	75,189	75,209	75,229	75,248	75,265	75,281	75,297
Morris	49,778	49,792	49,839	49,867	49,879	49,890	49,900	49,909	49,918	49,927	49,934
Ocean	75,382	75,409	75,440	75,465	75,486	75,506	75,525	75,542	75,558	75,573	75,586
Passaic	72,341	72,374	72,427	72,478	72,496	72,513	72,529	72,543	72,556	72,568	72,579
Somerset	29,861	29,863	29,887	29,905	29,915	29,923	29,932	29,939	29,946	29,953	29,959
Sussex	13,858	13,863	13,872	13,886	13,892	13,897	13,902	13,907	13,912	13,916	13,919
Union	71,042	71,049	71,094	71,132	71,150	71,166	71,181	71,194	71,206	71,218	71,228
Warren	9,867	9,868	9,883	9,892	9,899	9,904	9,910	9,915	9,921	9,925	9,930

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- *Beds: For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report (MMWR, March 18, 2020) and state reports of COVID-19 cases.*
- *ICU: The CDC report found that 24% of hospitalized cases require ICU care.*
- *Ventilators: Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.*

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

*The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.*

New Jersey Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	5/16	5/17	5/18	5/19	5/21	5/23	5/25
Bergen	103,752	103,797	103,831	103,872	103,976 (20,795) [4,991] {2,495}	104,068 (20,814) [4,995] {2,498}	104,144 (20,829) [4,999] {2,499}
Burlington	44,086	44,119	44,118	44,053	44,089 (8,818) [2,116] {1,058}	44,119 (8,824) [2,118] {1,059}	44,146 (8,829) [2,119] {1,059}
Camden	55,019	55,066	55,132	55,179	55,252 (11,050) [2,652] {1,326}	55,316 (11,063) [2,655] {1,328}	55,373 (11,075) [2,658] {1,329}
Essex	93,538	93,539	93,610	93,686	93,721 (18,744) [4,499] {2,249}	93,749 (18,750) [4,500] {2,250}	93,772 (18,754) [4,501] {2,251}
Gloucester	30,254	30,276	30,318	30,338	30,372 (6,074) [1,458] {729}	30,403 (6,081) [1,459] {730}	30,430 (6,086) [1,461] {730}
Hudson	87,613	87,611	87,622	87,651	87,702 (17,540) [4,210] {2,105}	87,743 (17,549) [4,212] {2,106}	87,780 (17,556) [4,213] {2,107}
Hunterdon	9,701	9,704	9,717	9,722	9,734 (1,947) [467] {234}	9,745 (1,949) [468] {234}	9,755 (1,951) [468] {234}
Mercer	33,705	33,725	33,754	33,744	33,772 (6,754) [1,621] {811}	33,795 (6,759) [1,622] {811}	33,817 (6,763) [1,623] {812}
Middlesex	91,630	91,657	91,704	91,750	91,785 (18,357) [4,406] {2,203}	91,815 (18,363) [4,407] {2,204}	91,841 (18,368) [4,408] {2,204}
Monmouth	75,042	75,065	75,121	75,167	75,209 (15,042) [3,610] {1,805}	75,248 (15,050) [3,612] {1,806}	75,281 (15,056) [3,613] {1,807}
Morris	49,778	49,792	49,839	49,867	49,890 (9,978) [2,395] {1,197}	49,909 (9,982) [2,396] {1,198}	49,927 (9,985) [2,396] {1,198}
Ocean	75,382	75,409	75,440	75,465	75,506 (15,101) [3,624] {1,812}	75,542 (15,108) [3,626] {1,813}	75,573 (15,115) [3,627] {1,814}
Passaic	72,341	72,374	72,427	72,478	72,513 (14,503) [3,481] {1,740}	72,543 (14,509) [3,482] {1,741}	72,568 (14,514) [3,483] {1,742}
Somerset	29,861	29,863	29,887	29,905	29,923 (5,985) [1,436] {718}	29,939 (5,988) [1,437] {719}	29,953 (5,991) [1,438] {719}
Sussex	13,858	13,863	13,872	13,886	13,897 (2,779) [667] {334}	13,907 (2,781) [668] {334}	13,916 (2,783) [668] {334}
Union	71,042	71,049	71,094	71,132	71,166 (14,233) [3,416] {1,708}	71,194 (14,239) [3,417] {1,709}	71,218 (14,244) [3,418] {1,709}
Warren	9,867	9,868	9,883	9,892	9,904 (1,981) [475] {238}	9,915 (1,983) [476] {238}	9,925 (1,985) [476] {238}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.